REMARKS

With this Amendment, Claims 1, 4, 8, 11 and 17 have been amended. Claims 1-13 and 17 are currently pending.

Claim Objections

The Examiner has objected to Claims 1-3 and 11-13 because the word --in-- is missing after "chemical" in Claim 1, and the word --water-- is missing after "DI" in Claim 11.

Applicants have amended Claims 1 and 11 in accordance with the Examiner's suggestion.

Accordingly, Applicants respectfully request withdrawal of the claim objections, and seek allowance of these claims.

Claim Rejections - 35 U.S.C. §§ 102/103

The Examiner has rejected Claims 1, 3-4 and 7 under 35 U.S.C. § 102(b) as being anticipated by McConnell et al. (US 4,899,767). The Examiner has also rejected Claims 2, 5-6, 8-10 and 17 under 35 U.S.C. § 103(a) as being unpatentable over McConnell et al.

It is Applicant's understanding that the cited references fail to teach or render obvious Applicant's invention as claimed in Claims 1-10 and 17.

Claims 1-3

With respect to Claims 1-3, Applicant teaches and claims a method of generating a measured amount of chemicals which are used in a single wafer semiconductor cleaning process. According to the present invention, chemicals are fed into a valve system having a tube of a known volume. The chemicals are fed into the tube to fill the tube and thereby obtain a measured amount of the chemical. The measured amount of chemical is then applied to a semiconductor wafer in a single wafer cleaning process.

Under 35 U.S.C. §102(b), a claim is anticipated only if the reference teaches each and every element of the claim. See MPEP §2131.

As argued below, McConnell et al. simply does not teach or suggest all the claim limitations of independent Claim 1.

In particular, McConnell et al. fails to teach filling a tube having a known volume with a chemical, wherein filling the tube generates a measured amount of the chemical approximately equal to the known volume of the tube.

In McConnell et al., the chemical is measured by the metering pump 44 (not the tank 32). McConnell et al. describes that, "The tank is maintained hydraulically full, so that by opening a valve associated with a selected treatment fluid from the tank, the metered volume of the selected treatment fluid is drawn into the tank." (Col. 4, lines 34-39). Furthermore, McConnell et al. indicates that the metering pump is provided "for withdrawing metered amounts of fluid from the tank". (Col. 4, lines 30-32). In describing the operation of the fluid delivery system, McConnell et al. teaches:

> When it is desired to introduce treatment fluid F1, F2, etc. into the tank in a measured amount, the valve corresponding to the desired treatment fluid is opened so as to connect that treatment fluid to a port 36 or 38 of tank 32. The valve (40a or 40b) which connects the metering pump 44 to the opposing port of tank 32 is also opened. Pump 44 is then turned on to withdraw the metered amount of fluid from the hydraulically full tank 32, thereby causing fluid from the reservoir of selected fluid to enter the tank.

(Col. 7, lines 45-54)

Accordingly, McConnell et al. does not teach or suggest a method of generating a measured amount of a chemical, wherein the chemical is measured by filling a tube having a known volume with the chemical, the amount generated being approximately equal to the known volume of the tube.

As such, it is Applicant's understanding that the cited art fails to teach or render obvious Applicant's invention as claimed in Claim 1. As Claims 2-3 are dependent on independent Claim 1, Claims 2-3 are patentable for at least these reasons. Applicant, therefore, respectfully requests the removal of the 35 U.S.C. §§ 102 and 103 rejections of Claims 1-3 and seeks allowance of these claims.

<u>Claims 4-7 and 17</u>

With respect to Claims 4-7 and 17, Applicant teaches and claims a method of mixing a precise amount of chemicals. According to Applicant's invention, a chemical is fed into a valve system having a tube of a known volume to generate a known amount of the chemical. DI water is then fed into the valve system to push the measured amount of chemical into a chamber with the DI water. DI water is continually fed into the chamber until the mixture of the chemical and DI water reach a predetermined volume in the chamber. A sensor can be used to indicate when the predetermined volume is reached. Accordingly, Applicant teaches measuring one chemical with a tube of a known volume and then measuring the

amount of the chemical/water mixture. Thus, in this embodiment of the present invention, the amount of dilutant or DI water is not directly measured but is indirectly controlled by measuring the volume of the water/chemical mixture.

Under 35 U.S.C. §102(b), a claim is anticipated only if the reference teaches each and every element of the claim. See MPEP §2131.

As argued below, McConnell et al. simply does not teach or suggest all the claim limitations of independent Claims 4 and 17.

In particular, McConnell et al. fails to teach filling a tube having a known volume with a chemical, wherein filling the tube generates a measured amount of the chemical approximately equal to the known volume of the tube.

McConnell et al. also does not teach or suggest pushing the measured amount of chemical out of the tube having a known volume by flowing DI water into the valve system.

As discussed above, in McConnell et al. the metering pump 44 (not the tank 32) generates the measured amount of fluid. In McConnell et al., the metering pump 44 also withdraws the fluid for delivery to the treatment vessel. As described above, McConnell et al. provides that, "The tank is maintained hydraulically full, so that by opening a valve associated with a selected treatment fluid from the tank, the metered volume of the selected treatment fluid is drawn into the tank." (Col. 4, lines 34-39); and, the metering pump is provided "for withdrawing metered amounts of fluid from the tank" (Col. 4, lines 30-32). In describing the operation of the fluid delivery system, McConnell et al. describes measuring and withdrawing the fluid as follows:

> When it is desired to introduce treatment fluid F1, F2, etc. into the tank in a measured amount, the valve corresponding to the desired treatment fluid is opened so as to connect that treatment fluid to a port 36 or 38 of tank 32. The valve (40a or 40b) which connects the metering pump 44 to the opposing port of tank 32 is also opened. Pump 44 is then turned on to withdraw the metered amount of fluid from the hydraulically full tank 32, thereby causing fluid from the reservoir of selected fluid to enter the tank.

(Col. 7, lines 45-54).

Accordingly, McConnell et al. does not teach or suggest a method of generating a measured amount of a chemical, wherein the chemical is measured by filling a tube having a known volume with the chemical, the amount generated being approximately equal to the known volume of the tube. McConnell et al. also does not teach or suggest flowing DI water into said valve system to push the measured amount of chemical into a chamber with the DI water.

As such, the cited art clearly fails to teach and render obvious Applicant's invention as claimed in Claims 4 and 17. As Claims 5-7 are dependent on independent Claim 4, Claims 5-7 are patentable for at least these reasons. Applicant, therefore, respectfully requests the removal of the 35 U.S.C. §§ 102 and 103 rejections of Claims 4-7 and 17 and seeks allowance of these claims.

<u>Claims 8-10</u>

With respect to Claims 8-10, Applicant teaches and claims a method of mixing a precise amount of chemicals. According to Applicant's invention, a chemical is fed into a valve system having a tube of a known length to generate a known amount of the chemical. DI water is then fed into the tube to push the measured amount of chemical into a chamber with the DI water via a first conduit into a third conduit. DI water is also fed through a second conduit. The DI water and chemical in the third conduit are combined with the DI water in the second conduit, the combined

flow being dispensed onto a spinning wafer. Thus, in this embodiment of the present invention, the amount of dilutant or DI water is not measured.

To establish a prima facie case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. In re Vaeck, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

Applicants respectfully submit that McConnell et al. does not teach or suggest all the claim limitations of independent Claim 8.

In particular, McConnell et al. fails to teach or suggest filling a tube having a known volume with a chemical to generate a measured amount of the chemical approximately equal to the known volume of the tube. McConnell et al. also fails to teach or suggest flowing DI water into a first conduit and into a second conduit, wherein the DI water in the first conduit flows into the valve system to push the measured amount of chemical into a third conduit and combining the flow of the measured amount of chemical and the DI water in the third conduit with the flow of DI water in the second conduit.

The Examiner points to Fig. 5 and Col. 12, lines 9-62 as teaching "a process comprising the steps of flowing DI water into first and second conduits, wherein the DI water in the first conduit flows into the valve system to push the measured amount of chemical into a third conduit, and combining the flow of said measured amount of chemical and said DI water in said third conduit with said flow of DI

water in said second conduit, and dispensing said combined flow onto a semiconductor wafer."

Applicant respectfully disagrees.

In the embodiment shown in Fig. 5 and described at Col. 12, lines 9-62 of McConnell et al., metering pump 148 also generates the measured amount of chemical. "The use of a recirculating flow loop 146a, 146b, 146c in the HF fluid delivery system allows metering pump 148 to operate at a constant speed, thereby enhancing its accuracy." See Col. 12, lines 46-49. And, at Col. 12, lines 57-60, McConnell describes that "... accurate control over the inlet water flow into which the HF is injected is maintained by adjusting the positioning valve 96 to obtain a desired flow rate, as measured by flow transducer 106." Hence, the chemical is measured and also withdrawn by pump 148 in McConnell et al.

Furthermore, in McConnell et al., the water flows through the conduits between valve 154 and valve 92, but the water does not flow through conduits 146a, 146b, 146c, or the conduit between valve 152 (incorrectly numbered in Fig. 5) and valve 154. At Col. 12, lines 35-39, McConnell et al. indicates that "It serves to allow very precise timing injection of fluid, as well as to provide an H_2O rinse circulation for valve 154 when valves 152, 154 are not connected in an injection mode."

McConnell et al. also indicates that this arrangement "is discussed in greater detail in the above referenced application Ser. No. 765,294." The following description is copied from Application Ser. No. 765,294 (U.S. Patent No. 4,778,532):

> This five port, <u>four way valve permits both recirculating chemical reagent and rinsing fluid to flow through the valve without mixing in one valve position</u>, while <u>in another position the flow of rinsing fluid into the valve is blocked and the chemical reagent inlet is connected to the outlet to the rinsing fluid stream</u>.
>
> It is also preferred that the concentrated chemical reagent be filtered through a filtration membrane prior to injection into the rinsing fluid. When the concentrated chemical reagent is not being injected into the rinsing fluid, but rather is being continuously recirculated, the concentrated chemical reagent is

> simultaneously being continuously filtered through the filtration membrane. The flow of the concentrated chemical reagent is preferably effected by a metering pump...
>
> <u>Subsequent to completing injection of the concentrated reagent, it is preferred that a portion of the flow of the rinsing fluid be directed to flow through the injection valve means to rinse the valve means and to rinse associated lines whereby the injection of the concentrated reagent may be abruptly terminated. A portion of the rinsing fluid is preferably diverted from the principal flow path to the path passing through the injection valve by means of an orifice plate.</u>
>
> The process employing the chemical reagent injection apparatus of the present invention may be illustrated with reference to the preferred embodiment of FIG. 1. A preferred injection system consists of a concentrated reagent reservoir 49, preferably containing a 50% by weight solution of hydrofluoric acid, a precision metering pump 50, a micron filter 51, and a five-port, four-way valve 52. The purpose of this apparatus is to inject an exact amount of solution into the flowing high purity rinsing fluid stream for a precisely controlled period of time. Prior to injection, pump 50 draws concentrated reagent out of reservoir 49, through filter 51, and through valve 52, back into reservoir 49. This preinjection recirculation allows for the metering pump to achieve a very precise flow rate. Transients in the system associated with beginning to pump are given time to level out. Simultaneously, the rinse fluid flow rate and rinsing fluid temperature are adjusted via flow control valve 46 and heater 38 to achieve precisely controlled conditions. Simultaneously, water bypass valve 45 is closed to permit precise flow of the rinsing fluid to give precise dilution of the concentrated reagent.
>
> <u>When all conditions monitored indicate that predetermined injection criteria are met, valve 52 switches so that concentrated reagent is injected into the flowing rinsing fluid line rather than being recirculated back to the reservoir.</u> A static mixer insures that the injected concentrated reagent is mixed well with the flowing rinsing fluid. In this manner, a precise and reproducible concentration of diluted chemical reagent can be pumped through the wafer vessel. Normally, valve 44 will be opened and valve 42 will be closed so that the dilute reagent is sent to the drain surge tank 208 rather than being recycled back to the rinsing fluid reservoir. (emphasis added).

Thus, the embodiment shown in Fig. 5 of McConnell et al. is directed to a system in which the chemical is withdrawn from the reservoir by the metering pump and only the chemical is combined with water at valve 154. The combined water and chemical mixture is then sent directly to the treatment vessel, in McConnell et al.

Accordingly, McConnell et al. does not teach or suggest filling a tube having a known volume with a chemical, wherein filling the tube generates a measured amount of the chemical approximately equal to the known volume of the tube. McConnell et al. also does not teach or suggest flowing DI water into a first conduit

and into a second conduit, wherein the DI water in the first conduit flows into the valve system to push the measured amount of chemical into a third conduit and combining the flow of the measured amount of chemical and the DI water in the third conduit with the flow of DI water in the second conduit.

As such, it is Applicant's understanding that the cited art fails to teach or render obvious Applicant's invention as claimed in Claims 8-10. Applicant, therefore, respectfully requests the removal of the 35 U.S.C. § 103 rejection of Claims 8-10 and seeks allowance of these claims.

Allowable Subject Matter

Applicants appreciate the Examiner's indication of allowability of Claims 11-13 if Claim 11 is rewritten or amended in accordance with the Examiner's suggestion to overcome the claim objection discussed above. As indicated above, Claim 11 has been amended in accordance with the Examiner's suggestion.

The Examiner has indicated that Claims 11-13 are allowable because "the prior art does not teach or fairly suggest flowing a chemical into a first valve system having a tube of known volume to generate a measured amount of chemical, flowing DI water into a second valve system having a known volume to generate a measured amount of DI water, and flowing an inert gas in both first and second valve systems to push the measured amounts of chemical and DI water into a chamber where the DI water and chemical are mixed together, and where the first and second valve systems are separate." Applicants respectfully submit that Claims 11-13 are patentable for other reasons as well.

Pursuant to 37 C.F.R. 1.136(a)(3), applicant(s) hereby request and authorize the U.S. Patent and Trademark Office to (1) treat any concurrent or future reply that requires a petition for extension of time as incorporating a petition for extension of time for the appropriate length of time and (2) charge all required fees, including extension of time fees and fees under 37 C.F.R. 1.16 and 1.17, to Deposit Account No. 02-2666.

Respectfully submitted,

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